PROBLEMS OF TRAINING NDT SPECIALISTS IN UKRAINE

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Introduction. The Non-Destructive Testing (NDT) specialists provide a quality exam for various kinds of products, conduct inspection of potential accident industrial objects, and provide their safe exploitation. Such branches of industry as aviation, ground transportation, nuclear power stations, and civil engineering can’t even exist without NDT specialists. All people need high quality products, to be protected from terrorism and technogeneous catastrophes. Thus, NDT specialists are desired in any society.

The features of professional activity. The professional activity of the NDT engineers has distinctive features as compared with common engineers. The fulfillment of complicated tasks with high level responsibility is expected from them not only high standard of knowledge in their field, but certain abilities and personal merits which are professionally required. This is the reason to emphasize some features of such profession which have to be taken into consideration at specialist preparation.

First of all, NDT engineers have to be able not only use the procedure and devices for discovering defects in an object, but have enough competence to take decision about availability of this object for further exploitation. The wrong decision can lead to human sacrifices. So, NDT engineers must have higher responsibility for a mistake the value of which can be very high. Thus, in this case the main advantages of a specialist are abilities to take decision in specific situation, to be responsible for this decision, and not only knowledge and profession skills.

The second, NDT engineers have to demand the stopping of object exploitation if they discover something wrong in it. So, specialists must have objectivity, persistence, adherence to principles, and so on.

Considering the requirements to the NDT specialists we can specify their abilities: high level of competence included knowledge and skills; understand the particulars of complicated situations and find the optimal solution; high professional and social responsibility. Question is: How is it possible to form necessary abilities for future specialists?

The problems of professional training. NDT is a complex specialty. Specialists have to acquire knowledge from different directions of engineering. Students study from physics of surface, electromagnetic field, optics, acoustics, and thermal physics to nucleus physics. Moreover, they have to know how to use electronics (microprocessors, microcontrollers), programming, and signal processing technique for designing automatic system of NDT. So, the process of forming student’s competence becomes complicated by some reasons. First of all, differentiation of the teaching content and extend student’s knowledge in one subject may lead to loss the logic connection with others. Sometimes student can’t perceive the system of knowledge as a whole system. Besides, the loss of subjects logic connection complicates forming and development of student system-logical thinking. As a result, future specialists don’t have system perception of their specialty, its professional and social aspects.

The second is a contradiction between knowledge extension and time limitation for teaching. It is obvious that the traditional informative method when the instructor tries to deliver large information content becomes ineffective. In any case, this information content won’t be enough to provide students for high level of competence during their professional career because engineering knowledge becomes old very soon. Therefore, it makes sense to

stimulate and develop the cognitive interest of students, forming the skills to get and use necessary information independently.

The third is a contradiction between the principles of knowledge unity and divided it into fundamental and special ones. This problem is directly connected with forming professional competence of the future specialists. On the one hand, students have to know fundamental subjects perfectly in order to become proficient in special ones. On the other hand, deepening into fundamental knowledge shifts the accent of student preparation and reduces time for studying special subjects which are the basis of professional competence and skills [1].

What is the professional competence? Now day European Union countries introduce a new system of education. This system of student preparation is directed at forming not only knowledge and skills but special competences also. The traditional system of education is based on tow ways of the educational process organization. The main feature of the first way is content of student training, i.e. what exactly instructor deliver is at the centre of attention. The second way is based on the process of training, i.e. the main feature is how the instructor delivers the course.

New system of education is based on the competence method approach which has result of education different from the traditional one. The result of education for new system is not amount of learned information only. It is also specialists' ability to apply this information to different complicated situations and get missing information independently. In other words, the result of student education is presence or absence necessary competences after their graduation.

The problem of competence-oriented education was considered in the papers of European authors - E. Short, Sim Shaw, A. Shelton, W. Hutmacher, T. G. Roos, and others. According to E. Short, competence is combination of knowledge, skills and operation [2]. Simon Shaw gave definition of the eight groups of base skills which were useful for professional activity and daily needs as well [3]. A. Shelton proposed the five groups of key competences which depend on professional activity of a person. The first one depends on psychophysical abilities of a person. These are abilities to attract attention, reaction time, coordination, and others. The second competence group is connected to professional abilities and skills. The third one determines cognition abilities, such as creative thinking and others. The fourth reflects individual abilities - self-reliance, responsibility, and aim at success. The fifth is social abilities – ability to cooperate and connectivity [4]. The description of the term "key competences" was given on European Council symposium in 1996. The report of European experts "Key Competences for Europe" was devoted to definition of five main groups of key competences which were very impotent for student preparation. There are political, social and cultural, communicative, social and informational, and personal competences among them.

The German scientist Roos T.G. considers that present-day worker has chance to find job if he possesses of a "competences portfolio". He mast solve a problem instead of fulfill a task.

The issue of education modernization is widely discussed in Ukraine also. According to Ukrainian law, quality of higher education is "total abilities of a graduated person which demonstrate professional competence, value direction, social orientation, and satisfy the personal and public requirements". One of the directions for education modernization is application competence-oriented approach more widely. It means forming activity skills in specific situations, in other words forming professional competence.

In general the specialists' professional competence we can represent as a combination of functional competences in common to the scientific, professional, individual – psychological, and social relations areas. Competence in common to the scientific area is a base of the given profession. It consists of common, subject, and academical competences. This conception is characterized by professional knowledge, intellectual activity, ability for analytic thinking, constructively discharge their obligations, and ability for extend their

knowledge. Competence in professional area can be form by professional, academical, key, personal, and others competences. It is characterized by ability for acting on the high level in specific professional area, realizing the program, and foreknown the results of this acting. Competence in individual – psychological area is based on personal competences which stimulate development of a personality in the context of a chosen profession, form the motivation for development of competence and tendency to check and evaluate of specialists' activity. The conception of competence in individual – psychological area is characterized by specialists' ability to study without assistance, to take decisions, and to account for specialists' activity. Competence in social relations area is based on social, personal, and key competences which provide for specialists' ability for working in a team, having social responsibility for the results of their professional activity, knowing and keeping to traditions, and managing of information and communication technology. Thus, acquired student knowledge and skills is a base of the future specialists' professional competence.

Professional competence of NDT specialists. Accordingly to Bologna Declaration, Ukrainian system of higher education has two levels of specialist preparation: bachelor and master's degree.

Present Ukrainian classification of professional activity in the technical field is divided on: performing, operating, producible- servicing, and researching levels. The specialist model has to describe the set of competences, professional duties, and the level of preparedness to accomplish specific functions.

Taking into consideration mentioned classification and professional activity features of NDT specialists; let's propose the structure of professional competence for specialists with bachelor and master's degree. The typical bachelor's professional activities in the NDT field are: experimental- research, manufacturing- servicing, calculation-design, and administration activities [5].

Competence in experimental- research activity provides a bachelor with abilities to:

- carry out the research of testing object models using present-day standard software and methods of mathematical simulation;
- realize experiments and result analysis using given procedure;
- study scientific and technical information

Competence in manufacturing- servicing activity is proposed bachelor's skills:

- to use NDT devices for inspection of products;
- to use monitoring systems for technologic forecasting of the object condition;
- to tune up, install, and activate software and hardware of NDT devices;
- to specify technical conditions of devices using monitoring devices.

Competence in calculation-design activity provides a bachelor with abilities to:

- calculation and design components of NDT devices;
- check capability of the projects and technical documentations to technical requirements;
- engineering design of technical documentations

Competence in administration activity provides a bachelor with abilities to:

- certification and standardization of NDT devices;
- organization marketing and selling of NDT devices;
- using economic and administrative methods of management

Analyzing bachelor's professional activities, we can consider that experimental-research activity belongs to common to the scientific area, manufacturing- servicing and calculation- design activities belong to professional area, and administration activity relates to individual – psychological and social relations areas.

It is obviously that specialist must be intellectual developed. Therefore, the footing of the bachelor's professional competence forming must develop students' creative abilities, namely: creative thinking and creative activity.

The master's training program is based on the bachelor's one. So, we consider that a future master is ready to fulfill the work that a bachelor can. The masters are preparing for following professional activities in the NDT field: research, design, and management activities [6].

Competence in research activity provides a master with abilities to:

- create of the mathematical and physical models of NDT devices;
- design procedure of the experiments and test operation

Competence in design activity is proposed master's skills:

- to analyze advanced direction of NDT devices development;
- to design technical documents for manufacturing of NDT devices

Competence in management activity provides a master with abilities to:

- organize management for improvement and modernization of NDT devices;
- search the optimal solution for making of NDT devices taking into account quality, reliability, and value requirements.

Let's refer research activity to common to the scientific area, design activity to professional area, and management activity to individual – psychological and social relations areas.

Professional competence of the master has to provide with implementation of an innovation cycle: scientific investigation work – research design work – manufacturing new product. In this case, the master's creative ability displays itself in master's research and innovation activities.

Conclusion. Present-day reality needs new well founded models for engineering education which take into account features of student's personality and requirements of industry. Forming of specialists' professional competence is one of the important problems of future engineer preparation. The specialist's professional competence is a complicated factor which includes prime competences based on acquired knowledge and skills. The footing of the specialists' professional competence forming is development of students' creative abilities.

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